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**HAWAII AGRICULTURAL EXPERIMENT STATION  
HONOLULU, HAWAII**

Under the supervision of the  
**UNITED STATES DEPARTMENT OF AGRICULTURE**

**EXTENSION BULLETIN No. 9**

**HAWAIIAN VEGETABLES AND  
THEIR FUNCTION IN  
THE DIET**

BY

**J. C. RIPPERTON, Chemist**

and

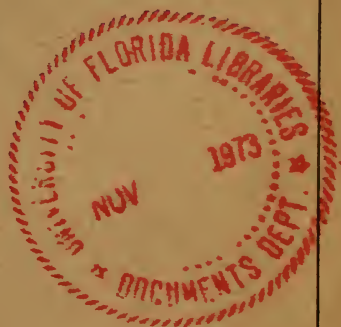
**NELLIE A. RUSSELL, Collaborator in Home Economics**



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## HAWAII AGRICULTURAL EXPERIMENT STATION, HONOLULU

[Under the supervision of the Office of Experiment Stations, United States Department of  
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CONTENTS

	Page		Page
Home-grown vegetables should be more extensively used in Hawaii	1	Relative costs of food constituents	9
Food constituents and their uses in the body	2	Food constituents in Hawaiian vegetables	11
Function of vegetables in the diet	5	How to use Hawaiian vegetables	13
Effect of cooking and canning	8	Varying the diet	22
		A week's bill of fare	23

HOME-GROWN VEGETABLES SHOULD BE MORE EXTENSIVELY  
USED IN HAWAII

Hawaii produces an abundant supply of vegetables throughout the year. Notwithstanding this fact, canned vegetables in large quantities are annually imported for use. The explanation of this is the opinion, prevalent among certain classes of the people, that locally grown vegetables are lacking in lime, iron, and other essential mineral constituents, and that they are not, for that reason, as good as the imported. Canned vegetables are on sale at nearly all groceries, and imported fresh vegetables are purchased at several times the price asked for home-grown sorts.

Recent advances in the field of nutrition, gained from the knowledge of substances called "vitamins," and the various functions of the different mineral elements in the human system, have led to a new and keen appreciation of the important place that vegetables<sup>1</sup> should occupy in the dietary.

The purposes of this bulletin are to show why vegetables should occupy an important place in the dietary, and how home-grown sorts can be advantageously adapted to the physical needs of people in Hawaii. With the information given in this publication, com-

<sup>1</sup> By the term "vegetable," as used in this bulletin, is meant the edible part of the fresh vegetable.

piled from various sources and including the results of some investigations carried on at the station, it is hoped that the housewife in Hawaii will find it a comparatively easy task to select and combine food materials providing a nourishing, wholesome, and economical diet.

### FOOD CONSTITUENTS AND THEIR USES IN THE BODY

Body needs that must be satisfied by food are classed under the following heads: Proteins, carbohydrates, fats, mineral substances, and vitamins. In arranging a dietary, it is not only essential that all these constituents be included, but they must each be present in the proper proportion. Most articles of food contain small amounts of a number of these constituents, but foods are grouped according to the chief contributions which they make; hence, the use of the terms "good protein food," "good mineral food," and the like. A consideration of the uses of these various constituents in the body may be of interest.

*Proteins.*—Proteins supply the body with material for building tissues, repairing waste, and yielding energy. Lean meat, milk, beans, peas, and lentils are familiar examples of food rich in proteins. The proteins are not all of equal nutritive value. Plant proteins are sometimes deficient in some of the essential constituents, hence protein in the form of meat is needed for growth. The average American diet contains nearly twice as much meat as does that of European or oriental countries. When more protein is eaten than is needed, the kidneys and liver are overtaxed and the general health sooner or later declines.

*Carbohydrates.*—The carbohydrates supply the body with the energy needed for muscular work. They consist of sugars, starches, and the more or less fibrous parts of plants, or cellulose. Unlike the proteins, nearly all the different sources of carbohydrate serve equally well as energy producers. Carbohydrates given in excess of the body needs are changed into fat and stored as reserve energy. The average American diet contains an undue quantity of sugar, the consumption per capita being 10 times greater than was the case 100 years ago. Sugar, when fed in excessive quantities, imposes a heavy burden on the liver and in addition to causing undue fermentation, generally upsets the digestive and excretory organs.

*Fats.*—Fat represents the most concentrated form of energy and, like protein and carbohydrates, serves as a fuel for maintaining the body temperature. It may be derived from animal fats, vegetable fats and oils, and from carbohydrates. It is a more effective source of energy than carbohydrates, yielding, when burned in the body, 2.25 times as many calories<sup>2</sup> as does the latter. As yet, it is not known whether fats can be entirely replaced by carbohydrates, but it is the consensus of opinion among nutrition experts that only a small amount is required for maintenance and that a very large proportion of the energy requirement can be met by carbohydrates.

<sup>2</sup> A calorie is the amount of heat required to raise the temperature of 1 pound of water about 4° F.



*Mineral substances.*—At least 10 different mineral elements are required for the growth and maintenance of the body. Each of these performs some vital function or functions, and is equally as important for health as are proteins, carbohydrates, and fats. Most plant foods contain them in some proportion, but the percentages vary within wide limits, and care must therefore be taken in preparing a diet to have each present in a sufficient amount to meet the body needs. Extensive nutrition investigations have shown that, except in very extraordinary cases, calcium, phosphorus, and iron are the only mineral substances which are not present in foods in amounts in excess of the body needs.

Calcium (lime) occurs in larger quantities in the body than is true of other mineral elements, being present in the proportion of about 2 per cent. With phosphorus, it constitutes approximately 85 per cent of the skeleton. It functions in numerous ways. A deficiency of calcium in the diet is detrimental to growth and health, particularly in the case of children. Lime may be added to the diet in mineral form, as for example by lime water, or as a constituent of the food. Vegetables, cereals, milk, and eggs are some examples of foods rich in calcium.

Phosphorus makes up about three-fourths of all the mineral constituents of the body. Although the greater part of this element exists as bone structure, it performs many other important functions, and is essential to every living cell. Phosphorus can be added to the diet either in mineral form as in phosphates, or as a constituent of food. Cereals and fish are familiar examples of food rich in phosphorus.

Iron, although present in the body in the proportion of only about two-thousandths of 1 per cent, is a very important constituent, being found in the red corpuscles of the blood. Anemia results when the diet is lacking in this element. Iron is therefore necessary in the food. Fruits, eggs, vegetables, and the coarser milling products of the cereal grains are rich in iron.

*Other mineral substances.*—Other mineral substances having an important function in the body include sodium, potassium, and magnesium, which influence the movements of the body fluids, and the beating of the heart, and insure the alkalinity of the blood; sulphur, which is a component of many proteins; chlorine, which furnishes acid in the stomach; and iodine, which acts as a preventive of goiter.

*Relation of mineral substances to alkalinity of the body.*—The body fluids should not contain acid-forming constituents in excess of the proportion required to form a neutral compound. The mineral substances are the agencies which are chiefly concerned in the reaction of these fluids, phosphorus and sulphur forming phosphoric acid and sulphuric acid, respectively, and calcium, magnesium, and potassium being the most important bases acting to neutralize these acids. The last three substances should be in excess of the proportion of acid-forming constituents present in order that they may serve as alkali reserves of the blood. If the acid-forming constituents are in excess, the condition known as acidosis may result. Table 1 shows the excess acid or base in the mineral matter of a number of vegetables and other foods.

TABLE 1.—*Excess acid or base per pound of the foods listed*<sup>1</sup>

Food material	Normal acid	Normal base	Food material	Normal acid	Normal base
	Cc.	Cc.		Cc.	Cc.
Cabbage.....		21.8	Fish, halibut.....	35.1	
Cauliflower.....		24.3	Meat, beef, lean.....	44.2	
Lettuce.....		27.9	Cheese.....	24.9	
Onions.....		6.2	Milk, cow's, whole.....		8.1
Spinach.....		122.0	Eggs.....	45.0	
Beans, Lima, fresh.....		29.0	Bread, white.....	31.9	
Beans, string, fresh.....		22.7	Rice, white.....	42.9	
Peas, shelled, fresh.....		3.3	Apples.....		12.8
Beets.....		39.4	Oranges.....		18.4
Carrots.....		37.8	Pineapples.....		30.8
Potatoes, white.....		26.0	Raisins.....		97.0
Potatoes, sweet.....		24.1			

<sup>1</sup> These figures denote the excess of acid or base in terms of cubic centimeters of normal solutions required for neutralization.

**Vitamins.**—Some of the most important advances in recent years in the realm of nutrition have resulted from the discovery of a group of compounds called vitamins, which exist in all natural foods and are absolutely essential to a continuation of the life processes. This immensely important group was practically unknown a decade ago, and their chemical composition is still little known. Vitamins can not be classed as foods in the sense that carbohydrates, fats, and proteins are, and they exist in very small quantities in even the richest sources. An adequate supply of vitamins in the diet serves not only to prevent disease, but also to promote normal growth and bodily function, and maintain general good health. The principal vitamins thus far discovered are the fat-soluble, the water-soluble, and the antiscorbutic, designated A, B, and C, respectively.<sup>3</sup>

Vitamin A is known as the fat-soluble vitamin, because of its presence in certain fats and oils. Butter, cheese, milk, egg yolk, certain of the fish-liver oils, and a number of vegetables are its chief sources. Most of the fats and oils used for cooking and for salad are devoid of this vitamin.

Vitamin B is known as the antineuritic vitamin, because of its function in preventing the disease called beriberi, which causes weakness and even paralysis. One of the first symptoms resulting from a deficiency of this vitamin is a loss of appetite. This vitamin is widely distributed in foods, vegetables, cereals, meats, eggs, fruits, nuts, and dairy products containing it.

Vitamin C is known as the antiscorbutic vitamin since its presence in the diet prevents scurvy. This vitamin occurs notably in vegetables and fruits.

A number of innovations in dietary practices have resulted directly from an increased knowledge of the vitamins. The raw salad, with its leafy vegetable and other vegetables or fruit, which until a few years ago was considered a fad, now takes rank as an important article of diet. Likewise, the feeding of the juices of tomatoes, spinach, and carrots to babies is becoming very common. Small quantities of water are now used in the cooking of vegetables, with

<sup>3</sup> Each of these vitamins may constitute a group of individual vitamins. Evidence suggesting that vitamins A and B should be thus subdivided has already been produced.

a proportionally shorter time for cooking than was formerly the case, in an effort to preserve the vitamins.

The only way to make certain that the diet contains an ample supply of vitamins is through the intelligent use of the natural foods. The actual amount of each vitamin needed daily, although probably small, should be present constantly in the diet. Table 2 gives the relative vitamin value of a number of food materials.

TABLE 2.—*Relative vitamin value of a number of food materials*

Source	Vitamin A	Vitamin B	Vitamin C
Artichokes (Globe).....	Good.....	Fair.....	Unknown.
Asparagus.....	.....	Excellent.....	.....
Cabbage (fresh, green).....	Good.....	Good.....	Excellent.
Cauliflower.....	Fair.....	Good.....	Fair.
Chard.....	Good.....	Fair.....	.....
Endive.....	Fair.....	.....	Fair.
Lettuce.....	Good.....	Good.....	Good.
Onions.....	.....	Fair.....	Good.
Spinach.....	Excellent.....	Excellent.....	Fair.
Water-cress.....	.....	.....	Fair.
Beans, string, fresh.....	Good.....	Good.....	Good.
Peas, shelled, fresh.....	Good.....	Good.....	Fair.
Beets.....	Very little.....	Fair.....	Fair.
Carrots.....	Excellent.....	Good.....	Good.
Parsnips.....	Poor.....	Good.....	.....
Turnips.....	Poor.....	Good.....	Good.
Potatoes, white.....	.....	Good.....	Good.
Potatoes, sweet.....	Good.....	Fair.....	Good.
Avocados.....	Fair.....	Good.....	.....
Cucumbers.....	Poor.....	Fair.....	Fair.
Eggplant.....	.....	Fair.....	Fair.
Papayas.....	Good.....	Fair.....	Good.
Squash, Hubbard.....	Good.....	.....	.....
Tomatoes.....	Good.....	Excellent.....	Excellent.
Meat, beef, lean.....	Poor.....	Fair.....	Poor.
Cheese.....	Good.....	Fair.....	Poor.
Milk, cow's, whole, raw.....	Excellent.....	Good.....	Good.
Eggs (yolk).....	Excellent.....	Good.....	Poor.
Bread, white.....	Poor.....	Poor.....	Poor.
Apples.....	Poor.....	Fair.....	Fair.
Oranges.....	Fair.....	Good.....	Excellent.
Raisins.....	.....	Fair.....	Poor.
Kohl-rabi.....	.....	.....	Fair.
Okra.....	.....	Excellent.....	.....

## FUNCTION OF VEGETABLES IN THE DIET

Since a balanced diet is made up of all the various food constituents in quantity sufficient to meet the needs of the body, it follows that certain constituents must not be used to the exclusion or partial exclusion of others. If, for example, lean beef, which is an excellent source of protein, is eaten singly in sufficient quantity to meet the daily needs of the body with respect to protein, it will furnish only 17 per cent of the energy, 6 per cent of the calcium, 52 per cent of the phosphorus, and 58 per cent of the iron required, and the excess of acid over mineral bases will lead to various physical disorders. To balance the meal there should be included with the meat a variety of other foods which are comparatively low in protein and high in the deficient meat factors. For instance, potatoes might be added to furnish energy, tomatoes and cabbage to furnish vitamins, and spinach to furnish iron and calcium.

No single food constitutes a balanced ration. Milk, one of nature's complete foods for the young, comes the nearest to being complete, but it is greatly deficient in iron. Vegetables play a very important



rôle in the well-balanced diet, being strong in the very factors in which other food materials are weak. Their nutritive value lies partly in the fact that they neutralize the acid substances produced in the course of digestion of meats, bread, cheese, and the like. (See Table 1.)

Vegetables are also of value as "roughage." Roughage in a diet promotes digestion. Vegetable constituents, particularly certain of the celluloses, tend to hold water and for that reason help to prevent constipation. Unfortunately, too many dietaries are made up of very rich food with an insufficient quantity of roughage or bulk to permit of proper digestion and assimilation.

Although all the vegetables are important sources of the various minerals needed by the body, some are more so than others, being especially rich in calcium and iron.<sup>4</sup> Cauliflower, for example, contains nearly ten times as much calcium as does meat, fourteen times as much as rice, and twice as much as eggs. Spinach contains more iron than does meat, fifteen times as much as milk, and four times as much as bread.

In addition to containing important mineral salts, vegetables are, as already explained, valuable sources of vitamins. Measured in terms of mineral matter, protein, or energy, the tomato, for instance, is of no particular importance. As a source of vitamins, however, it at once assumes a very important place in the dietary. It is claimed that, owing to its use by the American Army during the World War, the soldiers suffered less from scurvy than did those of the other nations.

Certain of the vegetables, such as the legumes, are sources of protein. Lima beans contain 7 per cent of protein, which is practically as much as white bread contains. Proteins from different sources vary greatly in their quality. Those of the legumes are not of very high nutritive quality. The relative inferiority of some plant proteins to animal proteins probably constitutes the chief objection to a diet made up solely of plant products.

*Nutritive value of the different vegetables.*—Each group of vegetables possesses properties which give it a special place in the dietary. A comparison of the nutritive value of some of the more commonly used members of the various groups follows.<sup>5</sup>

*Leafy vegetables.*—This group may be divided into two types, the thick-leaf sorts, such as cabbage, cauliflower, and onion, and the thin-leaf sorts, such as spinach, lettuce, and the like. It is of particular importance as a source of vitamins, and is a good source of the mineral elements, but among the poorest in energy. The leafy vegetables are characterized by high water content, and by reason of their succulence and relatively large bulk probably aid in the digestion of the more concentrated foods. Owing to the fact that their leaves are made up chiefly of living cells containing all the different food constituents necessary for growth, the leafy vegetables are especially

<sup>4</sup> When comparing the composition of vegetables with that of other kinds of food, it should be borne in mind that the former, especially the green sorts, contain relatively large quantities of water. Fresh spinach contains 0.068 per cent of phosphorus, or about two-thirds as much as does rice; dried spinach, having the same amount of moisture as does rice, contains 0.309 per cent of phosphorus, which is more than four times as great as that of rice.

<sup>5</sup> Chemical analyses are now under way at the station to determine the nutritive and mineral constituents of some of the more important locally grown vegetables.



valuable in the formation of balanced dietaries. They rank high in the dietary of oriental countries, where there is a limited supply of milk and dairy products. It has been found that a ration consisting of such staple foods as lean meat, dried legumes, tubers, and roots is inadequate to meet the body needs of omnivorous animals, but that the addition of leafy vegetables in even small quantities to the ration will correct the deficiency.

Cabbage, not outstanding in nutritive value, is of importance as a source of all three of the vitamins. Eaten raw or properly cooked, it is one of the best sources of the antiscorbutic vitamin C.

Cauliflower is especially high in calcium, containing nearly twice as much as any other vegetable. It is a luxury in Hawaii, where it is not extensively grown. Not being rich in vitamins as are some of the other leafy vegetables, cauliflower can not be especially recommended as a food except for its calcium content.

The onion is similar to the other thick-leaf vegetables in its food constituents, but is not so good a source of vitamins. Contrasted with the mild flavor of the other members of the group, the onion is characterized by a strong, distinctive flavor.

Spinach is a rich source of the vitamins and contains over three times as much iron as does any other member of this group. In its excess of base over acid, it is nearly five times as high as are the other vegetables. This very important vegetable should be accorded its proper place in the dietary.

Lettuce is similar to spinach in its dietary value, but is not so strong a source of mineral elements. It possesses good antiscorbutic properties, and is an important source of the vitamins.

*Pod vegetables.*—This group of vegetables belongs to the legume family, and is equal or superior in nutritive value to other green vegetables. It is especially rich in protein, and can therefore be used to a certain extent as a substitute for meat in the dietary. Dried legumes are important sources of energy, and fresh shelled legumes are fairly rich in the various vitamins. With regard to mineral matter, the legumes are excellent sources of phosphorus and to a less extent of iron. Their ash has a good excess of bases, which is not true of most of the other protein foods. Of the pod vegetables dealt with in this bulletin, peas and Lima beans show a striking similarity in all respects. String beans, picked while the pods are still tender and succulent and before the beans are well developed, have more of the properties of the leaf vegetable than of the legumes.

*Root vegetables.*—This group, though not an outstanding source of any of the various food constituents, is a very desirable addition to the diet. The root vegetables contain a higher percentage of water than do the tubers, more especially after cooking, and they can be used to supplement the more concentrated foods. Some of the root vegetables are important sources of the vitamins. This is true particularly of the carrot, which is used in salad making and is considered a desirable food for growing children. Among the root vegetables of Hawaii, kohl-rabi should be given a more important place in the dietary than it now occupies. This vegetable contains one and a half to three times as much phosphorus, calcium, and protein as do beets or carrots and practically equals them as a source of energy and iron.

*Tubers.*—This group consists chiefly of carbohydrate-yielding vegetables, such as the white and the sweet potato, and is an important source of energy. The sweet potato alone is said to be adequate to supply all that is needed of vitamin A and furnishes a palatable substitute for the potato. The vitamins of the white and sweet potatoes supplement each other, and all three vitamins are furnished when both kinds of potatoes are used. Owing to its mild flavor, the white potato can be used in the diet without becoming tiresome, and when consumed in any quantity it furnishes an abundance of mineral matter. Together with bread or rice, it forms the bulk of the average diet. Potatoes have an advantage over bread or rice, however, in that they contain an excess of base over acid, whereas the opposite is true of both bread and rice. A diet with potatoes as the principal vegetable is likely to be deficient in calcium.

### EFFECT OF COOKING AND CANNING

Cooking considerably influences the nutritive value of food. Vegetables must be cooked with care or they may lose some of their most valuable constituents; that is, mineral matter and vitamins. Recent studies show the advisability of cooking vegetables in smaller quantities of water for a proportionally shorter time than was formerly the case. Boiling results in the extraction of a considerable proportion of mineral matter. From 20 to 45 per cent of the mineral matter is extracted from spinach, for example, when it is boiled 45 minutes in a large quantity of water. Loss from this source can be greatly lessened if the spinach is boiled in a very small quantity of water, the time of boiling considerably shortened, and the liquid saved and used in soups, dressings, and the like. Losses of mineral matter are practically negligible in cases where roots and tubers are boiled with the jackets unbroken, and there is no loss when they are baked. Steaming is much to be preferred to boiling for most vegetables.

Opinions differ somewhat regarding the effect of cooking upon the vitamins of vegetables. It is generally agreed that vitamin A is not seriously injured by ordinary cooking processes, and that vitamin B is not destroyed to any great extent. Vitamin C is easily destroyed, however. Raw cabbage, which is rated an excellent source of vitamin C, loses its antiscorbutic properties to a considerable extent when it is cooked for 15 minutes, and completely loses these properties when the cooking is continued for an hour. Tomatoes may be cooked an hour and still retain sufficient of the vitamin to be of value during seasons when fresh vegetables are not available. In recent experiments with cabbage, canning by the ordinary process was found to be no more destructive to antiscorbutic properties than is home cooking in an open kettle for 20 minutes. In each case, however, the cabbage lost a large proportion of its original content of vitamin C. Dehydration has been found to be as destructive to vitamin C as is either ordinary cooking or canning. Neither dehydration nor canning appreciably destroyed vitamins A and B. Although it is still a question as to which is the best method of cooking, there is no doubt concerning the susceptibility of vitamin C to any method of cooking. This vitamin is destroyed in part even when the vegetable, such as cabbage, is exposed to the air

until wilting occurs. These facts serve to emphasize the importance of using fresh raw vegetables. The leafy vegetables need not be cooked to be assimilated; and, when they are eaten fresh and raw, the uncertain losses of mineral elements and vitamins are eliminated.

### RELATIVE COSTS OF FOOD CONSTITUENTS

Since dietary standards show the quantity of each food constituent daily needed by the body, the relative cost of each of the various foods can be fairly accurately computed in terms of daily average requirements of calcium, phosphorus, iron, protein, and energy (carbohydrates and fat). Table 3 gives a comparison of the cost of food constituents of vegetable and other foods. Column 3 shows the quantity of each food which would be required to furnish the various constituents needed to meet body requirements in the case of a person subsisting solely on one food. It must not be inferred from the figures in this column that the diet should include the full amount of any given food, since every other food also contains each constituent in some amount. Column 4 shows the relative cost of one day's requirements as furnished by the various foods.

TABLE 3.—Comparison of the cost of food constituents of vegetable and other foods

Kind of material	Calcium value <sup>3</sup>				Phosphorus value <sup>4</sup>			
	Price per pound fresh weight	Proportion of constituent in food <sup>1</sup>	Quantity of food needed to furnish daily requirement of constituent	Cost of one day's requirement of constituent <sup>2</sup>	Price per pound fresh weight	Proportion of constituent in food <sup>1</sup>	Quantity of food needed to furnish daily requirement of constituent	Cost of one day's requirement of constituent <sup>2</sup>
		<i>Per cent</i>	<i>Pounds</i>			<i>Per cent</i>	<i>Pounds</i>	
Cabbage.....	\$0.07	0.045	3.3	\$0.23	\$0.07	0.029	10.9	\$0.76
Cauliflower.....	.20	.123	1.2	.24	.20	.061	5.2	1.04
Lettuce.....	.04	.043	3.4	.14	.04	.042	7.6	.30
Onions.....	.06	.034	4.3	.26	.06	.045	7.1	.43
Spinach.....	.10	.067	2.2	.22	.10	.068	4.7	.47
Beans, Lima.....	.25	.028	5.3	1.33	.25	.133	2.4	.60
Beans, string.....	.10	.046	3.2	.32	.10	.052	6.1	.61
Peas, shelled.....	.25	.028	5.3	1.33	.25	.127	2.5	.63
Beets.....	.04	.029	5.1	.20	.04	.039	8.1	.32
Carrots.....	.05	.056	2.6	.13	.05	.046	6.9	.35
Kohl-rabi.....	.04	.077	1.9	.08	.04	.071	4.5	.18
Potatoes, white.....	.03	.014	10.5	.32	.03	.058	5.5	.17
Potatoes, sweet.....	.03	.019	7.8	.23	.03	.045	7.1	.21
Fish, halibut.....	.25	.017	7.4	1.85	.25	.167	1.8	.45
Meat, beef, lean.....	.35	.012	12.3	4.31	.35	.216	1.2	.42
Cheese.....	.40	.931	0.16	.06	.40	.683	0.46	.18
Milk, cow's whole.....	.10	.120	1.2	.12	.10	.096	3.4	.34
Eggs.....	.57	.067	2.2	1.26	.57	.180	1.8	1.03
Bread, white.....	.10	.027	5.5	.55	.10	.093	3.4	.34
Rice, white.....	.06	.009	16.4	.98	.06	.096	3.3	.20
Apples.....	.10	.007	21.1	2.11	.10	.012	26.4	2.64
Oranges.....	.09	.045	3.3	.30	.09	.021	15.1	1.36
Pineapples.....	.05	.018	8.2	.41	.05	.028	11.3	.57
Raisins.....	.18	.064	2.3	.42	.18	.132	2.4	.43

<sup>1</sup> These percentages are chiefly from Sherman's "Chemistry of Food and Nutrition," and his "Food Products."

<sup>2</sup> Column 4 is obtained by multiplying column 3 by column 1. When the cost of the pound varies from that given, the values in column 4 can be changed accordingly.

<sup>3</sup> Calcium requirement per day is 0.67 gram.

<sup>4</sup> Phosphorus requirement per day is 1.44 grams.



TABLE 3.—Comparison of the cost of food constituents of vegetable, etc.—Contd.

Kind of material	Iron value <sup>1</sup>				Protein value <sup>4</sup>			
	Price per pound fresh weight	Proportion of constituent in food <sup>1</sup>	Quantity of food needed to furnish daily requirement of constituent	Cost of one day's requirement of constituent <sup>2</sup>	Price per pound fresh weight	Proportion of constituent in food <sup>1</sup>	Quantity of food needed to furnish daily requirement of constituent	Cost of one day's requirement of constituent <sup>2</sup>
		<i>Per cent</i>	<i>Pounds</i>			<i>Per cent</i>	<i>Pounds</i>	
Cabbage.....	\$0.07	0.0011	3.6	\$0.25	\$0.07	1.4	11.0	\$0.77
Cauliflower.....	.20	.0006	6.6	1.32	.20	1.8	8.6	1.72
Lettuce.....	.04	.0007	5.7	.23	.04	1.0	15.4	.62
Onions.....	.06	.0006	6.6	.40	.06	1.4	11.0	.66
Spinach.....	.10	.0036	1.1	.11	.10	2.1	7.3	.73
Beans, Lima.....	.25	.0020	2.0	.50	.25	7.1	2.2	.55
Beans, string.....	.10	.0011	3.6	.36	.10	2.1	7.3	.73
Peas, shelled.....	.25	.0017	2.3	.58	.25	7.0	2.2	.55
Beets.....	.04	.0006	6.6	.25	.04	1.3	11.9	.48
Carrots.....	.05	.0006	6.6	.33	.05	0.9	17.2	.86
Kohl-rabi.....	.04	.0006	6.6	.25	.04	2.0	7.7	.31
Potatoes, white.....	.03	.0013	3.1	.09	.03	1.8	8.6	.26
Potatoes, sweet.....	.03	.0005	7.9	.24	.03	1.4	11.0	.33
Fish, halibut.....	.25	.0006	4.0	1.00	.25	18.6	0.83	.21
Meat, beef, lean.....	.35	.0030	1.3	.46	.35	20.0	.77	.27
Cheese.....	.40	.0013	3.1	1.24	.40	29.0	.53	.21
Milk, cow's whole.....	.10	.00024	16.5	1.65	.10	3.3	4.7	.47
Eggs.....	.57	.0030	1.3	.74	.57	11.9	1.3	.74
Bread, white.....	.10	.0009	4.4	.44	.10	9.2	1.7	.17
Rice, white.....	.06	.0009	4.4	.26	.06	8.0	1.9	.11
Apples.....	.10	.0003	13.2	1.32	.10	0.3	51.4	5.14
Oranges.....	.09	.0002	19.9	1.79	.09	0.6	25.7	2.31
Pineapples.....	.05	.0005	7.9	.40	.05	0.4	38.6	1.93
Raisins.....	.18	.0021	1.9	.34	.18	2.3	6.7	1.21

Kind of material	Energy value <sup>5</sup>			
	Price per pound fresh weight	Proportion of constituent in food <sup>1</sup>	Quantity of food needed to furnish daily requirement of constituent	Cost of one day's requirement of constituent <sup>2</sup>
		<i>Calories</i>	<i>Pounds</i>	
Cabbage.....	\$0.07	120	25.0	\$1.75
Cauliflower.....	.20	140	21.4	4.28
Lettuce.....	.04	70	42.8	1.71
Onions.....	.06	220	13.6	.82
Spinach.....	.10	110	27.3	2.73
Beans, lima.....	.25	560	5.4	1.35
Beans, string.....	.10	180	16.7	1.67
Peas, shelled.....	.25	450	6.7	1.68
Beets.....	.04	170	17.6	.70
Carrots.....	.05	160	18.8	.94
Kohl-rabi.....	.04	140	21.4	.86
Potatoes, white.....	.03	300	10.0	.30
Potatoes, sweet.....	.03	450	6.7	.20
Fish, halibut.....	.25	460	6.5	1.63
Meat, beef, lean.....	.30	650	4.6	1.38
Cheese.....	.40	2,100	1.4	.56
Milk, cow's, whole.....	.10	310	9.7	.97
Eggs.....	.57	600	5.0	2.85
Bread, white.....	.10	1,180	2.5	.25
Rice, white.....	.06	1,590	1.9	.11
Apples.....	.10	210	14.3	1.43
Oranges.....	.09	230	13.0	1.17
Pineapples.....	.05	196	15.3	.76
Raisins.....	.18	1,410	2.1	.38

<sup>1</sup> These percentages are chiefly from Sherman's "Chemistry of Food and Nutrition," and his "Food Products."

<sup>2</sup> Column 4 is obtained by multiplying column 3 by column 1. When the cost of the pound varies from that given, the values in column 4 can be changed accordingly.

<sup>3</sup> Iron requirement per day is 0.018 gram.

<sup>4</sup> Protein requirement per day is 70 grams.

<sup>5</sup> Energy requirement per day is 3,000 calories. The energy value of a food includes both carbohydrates and fats.

Table 3 brings out a number of interesting comparisons in cost between vegetables and other kinds of food. Nearly all the vegetables, except, of course, certain of the legumes and the tubers, provide a cheap source of calcium. Dairy products are comparatively rich in calcium, but the meats are poor. A large number of the vegetables, especially the roots, furnish phosphorus at a cost which is comparable with that of other foods, and most of the vegetables are a cheaper source of iron than other kinds of food. As sources of energy, the tubers and certain of the roots are among the cheapest.

In cost of food constituents, kohl-rabi is more economical than are either beets or carrots.

Cauliflower costs from two to five times as much a pound as the other members of its group. As a source of calcium, it is as economical as any other vegetable except lettuce; but it is extremely costly from every other standpoint. Cauliflower may be used occasionally to vary the diet, but other members of the group can be used much more economically.

Rice, although low in calcium and iron and poor in vitamins, is one of the cheapest sources of energy, protein, and phosphorus. It makes a decidedly economical and desirable food when its deficiencies are supplied by other foods in the diet.

Table 3 also serves as an approximate guide for meal planning, and can be used to correct dietary faults. For example, when meat and fish are served in place of cheese and milk, the meal is likely to be deficient in calcium and the vitamins, unless leafy vegetables in generous quantities are added to supply the deficiency. Likewise, a diet which is made up principally of bread and rice, instead of potatoes, will contain a dangerous excess of acids and be deficient in the vitamins.

### FOOD CONSTITUENTS IN HAWAIIAN VEGETABLES

In order to determine the mineral constituents of Hawaiian as compared with mainland-grown vegetables, preliminary analyses were made of one sample each of canned and dehydrated spinach, three samples of fresh Chinese spinach, the variety most commonly grown in Hawaii, and one sample of cabbage. Table 4 gives the results of these analyses.

TABLE 4.—*Comparison of mineral constituents of Hawaiian and mainland-grown spinach and cabbage*

[Calculated as percentages of dry material]

Vegetable	Where grown	Phosphorus	Iron	Potassium	Calcium
Spinach (canned).....		0.42	0.034	3.25	0.64
Spinach (dehydrated).....	Oregon.....	.83	.052	6.36	.59
Chinese spinach (fresh).....	Hawaii (Honolulu).....	.86	.071	5.91	2.03
Do.....	do.....				2.09
Do.....	do.....				2.01
Spinach (fresh) <sup>1</sup> .....	Virginia.....	.58	.063	7.14	.81
Cabbage (fresh) <sup>2</sup> .....	Ohio.....	.26		2.48	.59
Do.....	Hawaii (Mokuleia).....	.43	.031	2.66	.66

<sup>1</sup> Jour. Agr. Research [U. S.], 16 (1919), No. 1, p/ 17.

<sup>2</sup> Ohio Agr. Expt. Sta. Bul. 255, p. 226.

Later, through the cooperation of the United States Department of Agriculture and local growers, two leafy vegetables (spinach and cabbage), two root vegetables (carrots and beets), and two pod vegetables (peas and beans) were grown in two widely separate localities on the mainland (Virginia and Washington State), and also in two localities on Oahu, in order that a comparison might be made of their nutritive constituents. All the vegetables were from the same seed stock, and all were harvested at the same stage of maturity, and after being dried were sent to the station for analysis. The vegetables showed a number of variations, some of which were probably due to the soil and climatic conditions prevailing at each place. However, the results on the whole bore out the general conclusion of the preliminary work that locally grown vegetables are equal to the commonly imported kinds in the important mineral constituents.

Figure 1 graphically shows the relative amounts of calcium, phosphorus, and iron in three vegetables which were grown in Hawaii and on the mainland in 1921. Table 5 gives a comparison of the nutritive constituents and mineral elements found in Hawaiian and mainland-grown vegetables.

TABLE 5.—*Comparison of nutritive constituents and mineral elements in Hawaiian and mainland-grown vegetables*

[Calculated as percentages of dry material]

	Cabbage		Beets		Beans	
	Hawaii	Main-land	Hawaii	Main-land	Hawaii	Main-land
Nutritive constituents:						
Fiber.....	12.64	11.22	7.19	6.23	14.15	8.99
Protein.....	23.05	26.49	13.24	11.62	19.7	22.00
Fat.....	1.55	2.01	.33	.29	1.32	1.02
Nitrogen-free extract.....	51.71	48.93	67.77	72.87	55.56	61.25
Ash.....	11.06	11.37	11.48	9.02	9.23	6.40
Mineral elements:						
Potassium (K).....	3.95	4.38	3.70	4.02	3.66	2.52
Calcium (Ca).....	.67	.78	.09	.12	.38	.36
Magnesium (Mg).....	.35	.30	.22	.22	.34	.30
Manganese (Mn).....	.0018	.0025	.0019	.0042	.0016	.0019
Iron (Fe).....	.009	.014	.010	.012	.016	.015
Phosphorus (P).....	.45	.46	.33	.24	.50	.38
Sulphur (S).....	.62	.53	.12	.12	.09	.11
Chlorine (Cl).....	.63	.26	1.73	.36	.43	.08
Alkalinity <sup>2</sup> .....	102.80	118.80	119.90	113.10	105.90	81.00

<sup>1</sup> This figure may be in error.

<sup>2</sup> Expressed as cubic centimeters of normal acid solution required to neutralize excess of base per 100 grams of dry matter.

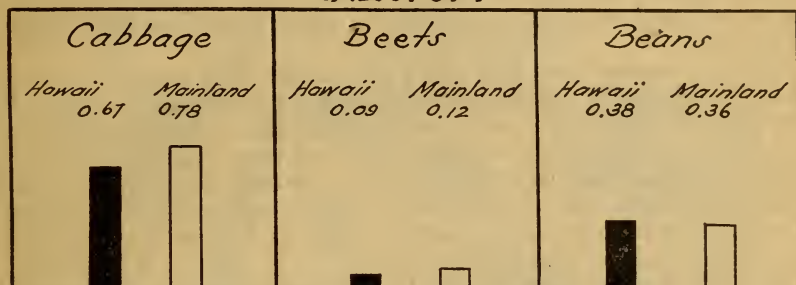
The popular belief that Hawaiian vegetables are lacking in mineral constituents seems to be based upon a misconception as to the deficiency of Hawaiian soils in certain essential mineral elements. That such is not the case is proved by nearly a thousand analyses of Hawaiian soils made at this station.

A chemical analysis of a soil is not always an accurate criterion as to its fertility, but station investigations show that Hawaiian soils are not devoid of any of the essential minerals; although, in actual percentages of the different constituents, they differ greatly from those on the mainland. A notable example of this is the abnormally large amount of iron. It is, indeed, puzzling to the layman to under-

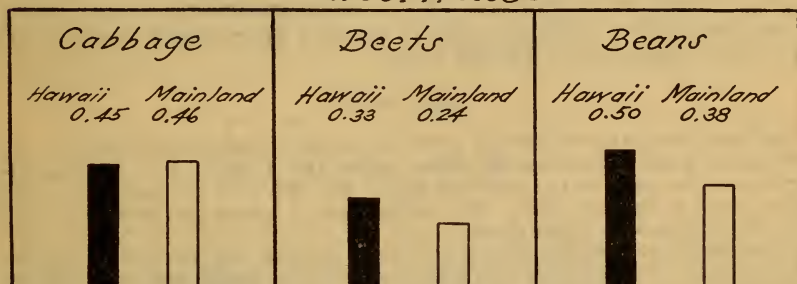


stand the practice of spraying iron sulphate on pineapples grown on soils so rich in iron. Work done at this station<sup>6</sup> shows that the iron in the soil is rendered unavailable to the pineapple plant, because of the presence of excessive amounts of manganese. However, this seems to be characteristic only of the pineapple plant, since

### CALCIUM



### PHOSPHORUS



### IRON

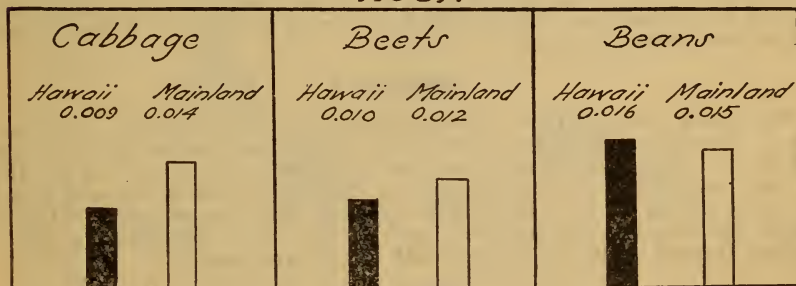


FIG. 1.—Comparison of the percentages of calcium, phosphorus, and iron content of vegetables grown in Hawaii and on the mainland of the United States

most other crops, notably vegetables, appear to grow normally on the same soils.

### HOW TO USE HAWAIIAN VEGETABLES

A very large part of the present population in Hawaii has come from regions having climates which produce foodstuffs differing in

<sup>6</sup> Hawaii Sta. Bul. 52, Manganese chlorosis of pineapples: Its cause and control.

taste and appearance from those grown locally. Many of these immigrants import favorite articles of foodstuffs from their native countries; others, not being able to do this, subsist on canned foods constituting their mainstay at home. When the dietary is so dangerously restricted as in the latter case, health is bound to suffer. Nutrition workers on the islands attribute the decayed teeth, malformed bones, and underweight of many of the children of the poorer oriental classes to the lack of fresh vegetables and fruits in their diet.

Dietary studies show that the needs of the body depend primarily upon the character and the amount and kind of work it does. The diet should therefore be adapted to meet the demands of a person at hard or at sedentary work, as the case may be, or to a growing child. It should not cater to "finicky" tastes. The ideal Hawaiian dietary need not differ from that of other countries in its proportion of food constituents; but it should, and in fact must, differ in its source of supply of these constituents.

In order that immigrants to Hawaii may familiarize themselves with the various kinds of vegetables which are produced locally, an alphabetically arranged list of the more commonly grown sorts is given, together with hints relative to their appearance on the market and their preparation for the table.<sup>7</sup>

#### ARTICHOKE

The artichoke, also called the globe artichoke,<sup>8</sup> consists of a head of thickened spiny green leaves having fleshy bases (Pl. I, fig. 1, 9). The thickened portion at the base of the leaf-like scales and the core or receptacle, are the edible parts of the artichoke. The edible part of young and tender artichokes may be eaten raw in salad form.

Preparatory to cooking, cut off the stem close to the leaves and the top of the bud; soak the heads in cold salted water for 2 hours, and then boil for 20 minutes. Remove parts of the flower in the center of the flower bud, chill the heads, and serve with mayonnaise in individual dishes. At table, the scales are pulled with the fingers from the cooked head, and the base of each leaf is dipped in mayonnaise. The artichoke can also be used as a hot vegetable served with drawn butter.

#### ASPARAGUS

The tender, young, white or greenish-white stems of asparagus are used as food. Preparatory to cooking, cut off the woody base and scrape the remaining stems with a sharp knife to remove all bitter bud bracts. Tie the stems in neat bundles and place them in boiling salted water for 20 minutes with the cut ends resting on the bottom of the vessel; then drop on sides so that the heads will be submerged and cook until tender. Serve with warm butter, or on well-toasted bread, and season with pepper and salt.

#### AVOCADO<sup>9</sup>

The avocado or alligator pear is an oval to pear-shaped fruit and in color may be purple, green, brown, or red. A large single seed occupies the center of the fruit, and the rind may vary from thin and delicate to thick and fibrous.

<sup>7</sup> The housekeeper undoubtedly understands that vegetables which have lost their crispness should be soaked in very cold water until they become crisp, and that all vegetables should be thoroughly washed before they are used; and, likewise, that as little water as possible should be used in cooking vegetables so as to decrease the amount of loss in mineral and other elements. The water in which tubers and root vegetables and "greens" are cooked should be used for vegetable soups, gravies, stews, and dressings.

<sup>8</sup> The globe artichoke should not be confused with the Jerusalem artichoke, which is a tuber.

<sup>9</sup> The avocado, breadfruit, and papaya, although fruits, are included in the list, because their use in the menu is similar to that of certain vegetables.



FIG. 1.—LEAFY VEGETABLES. (1) CHINESE SPINACH; (2) WATER CRESS; (3) TARO LEAF AND STALK; (4) RAPE; (5) CHINESE CABBAGE; (6) BEAN SPROUTS; (7) GREEN MUSTARD; (8) SWAMP CABBAGE; (9) ARTICHOKE; (10) COMMON CABBAGE; (11) LETTUCE



FIG. 2.—UPPER, CONDIMENTAL VEGETABLES; LOWER, POD VEGETABLES. (1) GREEN ONION; (2) GARLIC; (3) PICKLING ONION; (4) MATURE ONION; (5) CELERY; (6) SWEET PEPPER; (7) PARSLEY; (8) RED PEPPER; (9) LEEK; (10) LIMA BEANS; (11) CHINESE PEAS; (12) SNAP BEANS; (13) STRING BEANS; (14) WAX BEANS





FIG. 1.—ROOTS AND TUBERS. (1) BEET; (2) TARO; (3) COMMON ROUND TURNIP; (4) OYSTER PLANT; (5) CARROT; (6) CHINESE TURNIP; (7) KOHL-RABI; (8) LILY ROOT; (9) SWEET POTATO; (10) WHITE POTATO; (11) PARSNIP

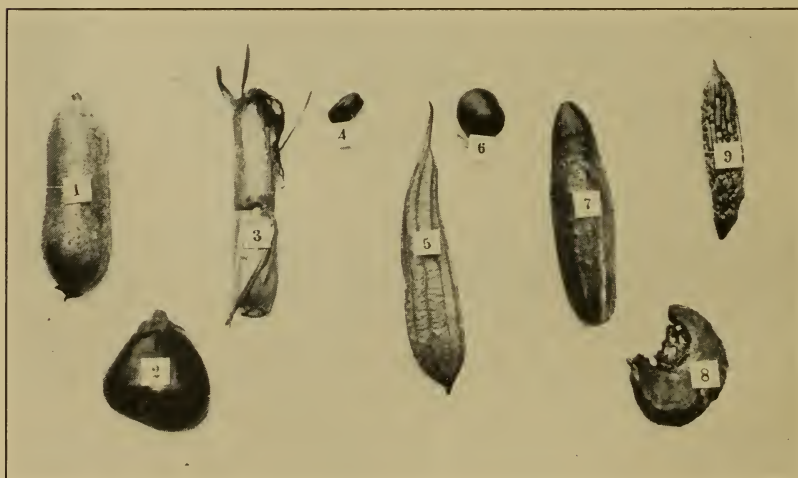


FIG. 2.—MISCELLANEOUS VEGETABLES. (1) CHINESE SQUASH; (2) EGG-PLANT; (3) GREEN CORN; (4) PLUM TOMATO; (5) LUFFA OR SPONGE GOURD; (6) COMMON TOMATO; (7) CUCUMBER; (8) HUBBARD SQUASH, SLICE; (9) BITTER MELON

The avocado is primarily a salad fruit. To prepare for the table, cut the fruit in half, remove the seed, and serve in the shell, seasoning with salt, pepper, and tomato catsup or French dressing. When served with hot consommé, spoonfuls of the pear should be dropped in the liquid immediately before serving. The diced meat may also be served with hot sauce. To make the sauce, stir into 1 tablespoon of flour and 1 tablespoon of melted butter, which have been well mixed, 2 tablespoons of vinegar, 1 teaspoon of salt, 1 teaspoon of sugar, 2 teaspoons of mustard, and 2 tablespoons of Chili sauce. Continue stirring until the sauce boils, then pour it over the sliced pear and serve.

#### COOKING BANANA

The cooking banana is similar in appearance to the ordinary "eating banana," but usually is larger and has a more pronounced stem. Cooking bananas are sold on the market by the "hand."

The cooking banana is not edible raw. When the skin has turned black, the whole banana (skin and meat) should be baked for 30 minutes. To serve, split the skin with a fork and season the fruit with a little lemon juice and butter.

To make banana sauce, boil half a cup of water with one-fourth cup of sugar, and add a small piece of lemon peel. Peeled bananas which have been cut in pieces an inch long should then be dropped into the mixture. Cook slowly for 30 minutes and serve cold.

#### BEAN SPROUTS

Bean sprouts consist of the slender, white shoots which grow from germinating beans (Pl. I, fig. 1, 6).

Wash the sprouts well and boil them for 5 minutes in salted water. Add butter, pepper and salt, or chopped bacon and pepper. Cook slowly until done. Bean sprouts are used for making chop suey.

#### SHELLED LIMA BEANS

These beans are large, flat, and slightly kidney-shaped (Pl. I, fig. 2, 10). Lima beans should be used the day they are purchased, as they mold readily. Wash the beans well and cook them for 20 minutes in enough boiling salted water to cover. Toss for a minute in finely chopped fried bacon, or mix with an equal quantity of canned corn and a little butter. The latter dish is called "succotash."

#### SNAP BEANS

Snap beans, sometimes called "long beans" and "Lazy Housewife beans," are sold in their pods (Pl. I, fig. 2, 12). Break off and discard the ends of the pods, wash the remainder well, and place in cold water to make them crisp. Cut the pods into short lengths for cooking, and drop them into a small quantity of boiling water. Cook rapidly for 5 minutes, and if possible let the water evaporate. Season with salt, pepper, and butter, and cover closely. Place the beans over a slow fire and cook for 30 minutes longer.

Care should be taken not to cut and soak the beans for hours before cooking, nor to cook them in too much water, since they will lose some of their flavor and food value.

#### STRING BEANS

Green or string beans are similar to snap beans, but usually are smaller than the latter (Pl. I, fig. 2, 13). Prepare and cook like snap beans. Remove all long fibers or "strings" during preparation for cooking.

#### WAX BEANS

Wax beans, also called "yellow" or "butter beans," are similar in shape to string beans, but are yellow in color (Pl. I, fig. 2, 14). They should be prepared and cooked like snap beans.

#### BEETS

Beets are of a deep red color and of spherical shape (Pl. II, fig. 1, 1). After removing the tops, wash the roots and place them in cold salted water. Bring

to a boil and cook for 45 minutes. Pour cold water on the cooked vegetable, remove the skin, and serve hot with butter, pepper, and salt, or cold with vinegar and sugar, and with garlic, if liked.

#### BEET GREENS

Beet greens are the leafy tops of the beet. Break them from the freshly pulled beets; do not cut. Wash the leaves in several waters and cook them for 20 minutes in a small quantity of boiling salted water. Chop in rather fine pieces. Season with butter and canned cream. Serve hot.

#### BITTER MELON

The bitter melon has a warty rind which varies in color from green to yellow (Pl. II, fig. 2, 9). To prepare for the table, wash and scrape; do not peel. Sprinkle with salt. Let it soak for an hour, then wash it again. Bitter melon makes a splendid lining for casserole dishes such as chicken, squab, kidney, or meat.

#### BREADFRUIT

Breadfruit is oval or spheroid in shape and about the size of a melon. Its skin is green in color and is hexagonally marked. Some types are covered with short, hard projections. Cover the stem axis with salt. Keep the fruit in a dark place until it turns brown. To prepare for the table, twist off the stem or stalk, and place the fruit in a moderate oven to bake for 45 minutes. Serve in skin like baked potatoes, breaking open and seasoning with butter, pepper, and salt.

#### CABBAGE

Common cabbage is in the form of a firm, dense head of tender, thickened leaves, the outer ones of which are green, and the inner white (Pl. I, fig. 1, 10). To serve in salad form, shred the head fine, crisp on ice, and cover with boiled dressing.

To cook, cut the head into quarters and soak for 30 minutes in cold, salted water. Cut into smaller pieces and boil in salted water for 30 minutes. Squeeze dry. Put in a bowl and mix well with a small quantity of finely chopped fried bacon. Cabbage is delicious when boiled with ham or corned beef.

#### CHINESE CABBAGE

Chinese cabbage, or "white mustard," as it is sometimes called, consists of pure white, close-growing stems having green leaves and small yellow flowers (Pl. I, fig. 1, 5). To prepare for the table, cut the cabbage into lengths and cook for 30 minutes in boiling salted water. Add lemon juice and butter; toss over hot fire for two minutes, then serve.

#### SWAMP CABBAGE

Swamp cabbage, long greens, or the Chinese "Ong-choi," consists of the green tops of a vine having hollow, tubular stems (Pl. I, fig. 1, 8).

Cut the cabbage into small pieces, as if preparing it for soup. Cook for 15 minutes in enough water to cover; drain and add butter and canned cream.

#### CARROT

The carrot is a spindle-shaped root which varies in color from yellow to deep orange (Pl. II, fig. 1, 5). The roots are usually sold in bunches.

To prepare for the table, wash and scrape the carrots; cut into slices and place in cold water. Boil for 30 minutes. Chop fine and serve with butter or with beef gravy, or cut into cubes and cover with cream sauce.

#### CAULIFLOWER

The cauliflower consists of a head of thickened white flower clusters having coarse outer green leaves.

Soak cauliflower in cold salted water, head down, for at least two hours. Worms or other forms of animal life in the vegetable will then crawl out. Boil the cauliflower for 20 minutes in a pan containing enough water to cover the vegetable. Serve with cream or butter.



## CELERY

Celery consists of a bunch of fleshy, close-growing, branched leafstalks (Pl. I, fig. 2, 5). The imported celery is blanched, that grown locally is green. The former is the more expensive of the two sorts, but the locally grown is the better for salad making. It is also used for flavoring soups, stews, and stuffings. The tender, white heart may be eaten raw or chopped fine for salad. Scrub the celery well, and place it on ice in a cheesecloth bag to crisp. When ready to use, chop the celery fine, using half quantity for salad purposes. The outer stalks should be cut in inch lengths, put in a very small quantity of boiling salted water, and cooked rapidly for five minutes. Add butter, and cook slowly for 30 minutes in a closely covered pan.

## SWISS CHARD

Swiss chard, also called "silver beet" and "leaf beet," is a variety of beet in which large fleshy, succulent stems having thick, broad leaves, develop instead of the root. It is a very suitable vegetable to grow in a small garden, since its outer leaves can be removed and used without injuring the plant. Chard is best cooked like spinach in very little water. It should be stirred until it settles in the water. Cooking in a large quantity of water will spoil its flavor.

## CORN

In corn, also called "green corn," the ears are sheathed in green husks and contain the soft, white grain kernels which constitute the edible part (Pl. II, fig. 2, 3).

Choose corn which is white and rather crisp. Remove the husks and the "silk" and place in boiling water, to which has been added a little sugar. Cook five minutes. Let the corn remain in the water until it is time to serve.

## CUCUMBER

The cucumber is a fleshy, cylindrically shaped vegetable of greenish-white color (Pl. II, fig. 2, 7). It is very palatable and should be eaten at least once a week. To cook, peel the vegetable and slice it lengthwise in four parts. Boil rapidly for five minutes. Season with butter, pepper, and salt. Cover closely, turn fire low, and cook for 30 minutes.

## EGGPLANT

The eggplant is usually oval in shape, large, and of a dark purple color (Pl. II, fig. 2, 2).

To fry, peel thinly and cut in slices. Sprinkle each slice with salt and place one upon another; keep between two plates for two hours with a weight on top. At the end of that time dip the slices in flour which has been mixed with pepper and salt, then dip in beaten egg, and finally in bread crumbs. Drop the slices into deep, hot fat, and cook them for four minutes.

To cook whole, remove the top and some of the seeds and stuff with a force-meat, such as rice or potato meat hash, or a bread-crumb dressing, such as is used to stuff a baked chicken. Spread butter on top and bake the eggplant for 20 minutes in a hot oven.

## ENDIVE

Endive or chicory consists of greenish-white stems having finely divided and much curled light-green leaves. Endive is used to garnish fruit salad and is considered a tonic by many because of its bitter flavor. Crisp on ice in a cheesecloth bag and serve very cold with French dressing made as follows: To 2 tablespoons strained lemon juice add 4 tablespoons olive oil, 1 teaspoon sugar, 1 teaspoon salt,  $\frac{1}{2}$  teaspoon mustard. Beat vigorously for 1 minute and pour over just before serving.

## GARLIC

Garlic resembles a mature onion in appearance, but has a white, papery outer shell (Pl. I, fig. 2, 2). It is characterized by a strong flavor and odor, and may be eaten either raw or cooked. It is a favorite ingredient in many dishes. Remove the outer shell of one of the divisions or "cloves," as they are called, and slice through. Use in small quantities, as the flavor is very strong.

**KOHL-RABI<sup>10</sup>**

Kohl-rabi forms an oval-shaped, fleshy bulb just above the ground and bears purplish leaves and stems (Pl. II, fig. 1, 7). This vegetable is used as a substitute for the common root vegetables, such as beets and carrots. The smaller bulbs, having crisp, new leaves, are much more satisfactory than are the large ones, which are tough and fibrous when fully mature. Cut the leaves and bulb in small pieces. Boil the bulb in salted water for 15 minutes, then add the leaves and cook an additional 30 minutes. Slice the bulb, arrange the greens around the edge of the dish, and place the slices in the center. Season with melted butter.

**LEEK**

Leeks are long white stalks having green tops (Pl. I, fig. 2, 9). This vegetable is distinguished from the onion by its smaller cylindrical bulb and broadly linear succulent leaves. To prepare for the table, remove the roots and some of the green tops. Serve raw as a relish, or chop fine for salad. To cook, cut in inch lengths, cover with boiling water, and cook rapidly for 10 minutes. Add butter, cover closely, and cook slowly for 20 minutes.

**HEAD LETTUCE**

Manoa head lettuce, also called "California lettuce," consists of a loosely formed head of pale-green to white leaves. Head lettuce is prepared and served like the ordinary nonheading lettuce. It is milder in flavor than the nonheading sorts.

**NONHEADING LETTUCE**

Nonheading lettuce, or "Chinese" and "Los Angeles lettuce," as it is also called, consists of large, somewhat curled green leaves which are attached to a single stalk (Pl. I, fig. 1, 11). Too often only the heart of nonheading lettuce is eaten. The outer leaves should also be eaten, as they have food value. To prepare for salad, wash the lettuce and the tender heart and put them on ice in a cheesecloth bag. Another way of serving is to tie the outer leaves together and drop them into hot soup for 5 minutes. Remove the lettuce, taking care to retain its shape, and squeeze dry. Cut in inch lengths and serve hot capped with grated cheese, or chop fine and serve with melted butter and a little cream. Nonheading lettuce is delicious served wilted with bacon.

**LILY ROOT**

Lily root, or lotus, consists of a long, thick, flesh-colored root which is divided into sections resembling the links of sausage (Pl. II, fig. 1, 8). To prepare for the table, peel the roots, slice, and cook 10 minutes. Use in stews, chop sues, and the like.

**LUAU**

Luau is another name for young taro leaves (Pl. I, fig. 1, 3). When it is sold as luau, the taro leaf is rolled tightly into scrolls and sold in bunches of six or more. Formerly only the unfolded crisp young leaves were sold; now, however, the older leaves also are curled and sold. Pinch the leaf between the finger and the thumb to determine its crispness; if the leaf breaks it is young and tender, but if it ceases without breaking it is likely tough and will probably "bite" the throat. To prepare for the table, boil for 10 minutes in plenty of water; then change the water, add salt, and cook for an additional 30 minutes. Chop fine and serve hot.

**LUFFA**

Luffa or sponge gourd is a large, green, tapering fruit having a corrugated skin (Pl. II, fig. 2, 5). It is found on the markets in abundance in the spring, and is said to possess medicinal properties. The luffa has a biting flavor which affects some people's throats, and for this reason should be used while it is small and tender. It is a common ingredient of vegetable soups and stews, and is used to flavor pot roasts. To bake, place in a casserole with equal quantities of sliced tomatoes and buttered bread crumbs, and cook slowly in the bottom of the oven for 45 minutes.

<sup>10</sup> Kohl-rabi is in reality a species of cabbage, but is classed with the roots and tubers (see Pl. II), because of similarity of use in the diet.

## MINT

Mint, or peppermint, consists of small, aromatic green leaves. It may be chopped fine and used in small quantities in fruit cocktails and salads, or used whole for flavoring jelly. Chop fine and mix with sugar and vinegar for mint sauce. Mint is also cooked with peas and new potatoes and to flavor preserves and chutney.

## GREEN MUSTARD

Mustard comes in the form of pale green, fleshy stems having crumpled green leaves and small yellow flowers (Pl. I, fig. 1, 7). Choose when the leaves are crisp and a vivid green. Cut crosswise into small sections and boil in a very little water for 5 minutes. Drain and season with butter, pepper, and salt. Cover and cook over a slow fire for 30 minutes longer.

## OKRA

Okra or gumbo is a small, light green tapering pod having corrugated skin. This vegetable is often mistaken for the luffa, but is much smaller and less inclined to be tough and strong flavored. Both vegetables are used rather interchangeably by most people in Hawaii, and both are cooked alike.

## GREEN ONION

Green or immature onions are long, slender white stalks having tubular green leaves (Pl. I, fig. 2, 1). To prepare for the table, remove the green tops, and serve raw as a relish in salad, or chop and put in stew.

## MATURE ONION

The Spanish or Bermuda onion is a spherical-shaped or flattened bulb having a dead, shriveled stem and a dry, tan-colored, papery outer husk (Pl. I, fig. 2, 4). To prepare for the table, peel from the root up, place in rapidly boiling water and cook for 5 minutes. Let the water evaporate, and season the vegetable with butter, salt, and pepper. Cover closely and steam for 30 minutes. To bake, place for 5 minutes in rapidly boiling salted water, then remove, and put under meat to be roasted.

## PICKLING ONION

Pickling or Portuguese onions are small, round, partly mature bulbs which are sold in bunches (Pl. I, fig. 2, 3). Owing to their flavor, they are especially fine for pickling whole in vinegar, or for use in stews and salads. To pickle, select very fresh onions and peel them from the root up, taking care to keep the bulb whole and round. While peeling, drop into a salt solution made by dissolving 2 tablespoons of salt in 2 cups of cold water to prevent discoloration and softening. When ready to pickle, which may be done immediately if desired, dry on a cheese cloth and drop into a hot sterilized bottle adding boiling hot vinegar to cover. To prepare the vinegar for 4 pounds of small onions boil 2 cups of malt vinegar with 1 tablespoon of salt, 1 dozen peppercorns, 6 allspices, 3 bay leaves, and 6 small red peppers. Seal the bottled onions and keep them in a dark place.

## OYSTER PLANT

The oyster plant consists of long, slender, fusiform brown roots (Pl. II, fig. 1, 4). In Hawaii it is at its best in May and June. To prepare for the table, scrape the roots in water, cut in half lengthwise, and then in inch pieces. Cook rapidly in boiling salted water for 5 minutes. Drop the pieces into a thin cream sauce and cook 30 minutes longer. To fry: Cut in half lengthwise and then in 3-inch lengths. Dip in flour, pepper, and salt, then in egg, and finally in cracker or bread crumbs. Cook 5 minutes in deep fat.

## PAPAYA

The papaya, sometimes called the pawpaw, is a fruit of green color and varies from round to oblong in shape. It resembles a melon in appearance. When the fruit is partly mature it may be used as a vegetable. To prepare for the table, peel the fruit under water and cut open to remove the seeds



and pith. Cut in squares and drop in boiling salted water. Cook rapidly for 5 minutes, then season with butter. Cover closely and steam slowly for 30 minutes.

#### PARSLEY

Parsley consists of sprays of bright-green, finely curled, dissected leaves (Pl. I, fig. 2, 7). It is used for garnishing and also to flavor soups, stews, sauces, and the like. It is chopped fine for salads.

#### PARSNIP

Parsnips are long, tapering, tan-colored roots (Pl. II, fig. 1, 11). They have a rather distinctive flavor, for which one usually has to acquire a liking. To prepare for the table, peel the vegetable thickly and cook for an hour in enough water to cover. Mash with milk and season with pepper and salt. Another way of serving is to mash the parsnips with finely chopped pieces of salted pork which has been fried to light brown.

#### CHINESE PEAS

Chinese peas are small, immature seed which grow in straight, bright-green pods (Pl. I, fig. 2, 11). In this variety both pods and peas are edible. To prepare for the table, top and tail the peas and wash them well, then drop them in boiling water and cook rapidly for five minutes. Have at hand a pan containing salad oil and a few lettuce leaves. Place the peas on the leaves, cover closely, and steam for 20 minutes. Season and serve hot.

#### SHELLED PEAS

Shelled peas, like the Chinese peas, are light-green seeds which grow in straight, green pods. Only the peas are to be eaten, the pods being discarded, as they are fibrous and unpalatable. Shelled California peas are on the market in May, June, and July. To prepare for the table, wash the peas well and drop them in boiling water to which salt, sugar, and a spray of mint have been added. Cook slowly for 20 minutes; serve hot.

#### RED PEPPER

Red peppers, also called "long peppers" and "Chili peppers," are in the form of tiny tapering pods of either red or green color (Pl. I, fig. 2, 8). They are used in pickling, in chutney, and for flavoring. One pepper is enough for a stew and six are sufficient to make a quart of chutney hot. Care should be taken not to break the peppers when removing the stem and washing. Children should not be allowed to finger red peppers, because the juice is likely to burn them.

#### SWEET PEPPER

Sweet peppers, also known as Bullnose and Bell peppers, are large, bright-green pods having a blunt end (Pl. I, fig. 2, 6). Remove stems and scoop out the seeds from eight large peppers. Stuff with the following mixture: To 2 tablespoons of melted butter add 1 cup of stale bread crumbs, 1 tablespoon of finely chopped onion, 1 tablespoon of parsley, and 3 tablespoons of chopped ham or other cooked meat, with salt and pepper to taste. Top each stuffed pepper with a piece of raw bacon and bake 30 minutes. Serve hot with brown gravy. To garnish salad, wash the peppers and put them in cheesecloth on ice for two hours to crisp. Cut them in slices and serve on the salad.

#### POTATO

The white potato, sometimes erroneously called the "Irish potato," is a spherical to oblong-shaped tuber (Pl. II, fig. 1, 10). New potatoes afford a pleasant change for the table. Wash the potatoes and scrape under water. Then place them on the fire in cold water, and when the water comes to a boil add salt, a spray of mint, and a thin slice of lemon. Cook for 15 minutes; then drain, place a layer of cheesecloth over the potatoes to prevent the moisture from escaping, cover with the lid of the container and cook over a slow fire for 5 minutes. Season the cooked potatoes with butter and serve hot.

Old potatoes are preferably baked in their jackets. Scrub, and place in a moderately hot oven. To cook for potato salad, place the whole potatoes (including skin) in enough water to cover, and boil with an onion for 20 minutes. Drain and thoroughly dry.

#### SWEET POTATO

The sweet potato is a large, elongated root varying in color from yellow to reddish-purple (Pl. II, fig. 1, 9). It is at its best when baked. Scrub the tuber under water, then place it in the oven without breaking the skin, and bake for 45 minutes.

#### RAPE

Rape, also called "Portuguese cabbage," consists of stems having deeply lobed green leaves and small white or yellow flowers, (Pl. I, fig. 1, 4). Choose the vegetable when the young blossoms show a touch of yellow. It is very strong tasting when the blossoms have faded. Cook for 30 minutes in boiling salted water; season with grated coconut or tomato catsup.

#### SHALLOT

Shallots are small clustered bulbs which resemble partly mature pickling onions, but have fine, slender leaves. To cook, remove the tops and steam the bulbs. Serve with butter. The delicate nutty flavor of shallots is very pleasing.

#### SPINACH

Spinach, or Chinese spinach, consists of slender, succulent stems having small, rounded or slightly pointed leaves which are arranged in a rosette (Pl. I, fig. 1, 1). It is in season throughout the year in Hawaii. To prepare for the table, remove the roots, separate the leaves and wash them well, continuing to change the water until there is no trace of sand in the bottom of the pan. Place the vegetable in a small quantity of boiling water to which salt has been added, and press down the spinach until it is covered by the water. Cook rapidly until thoroughly wilted, drain, and squeeze dry. Chop fine, season with butter and a little cream, and serve hot.

#### CHINESE SQUASH

Chinese squash, or winter melon, is an elongated melon of light green color (Pl. II, fig. 2, 1). When young it has a characteristic "fuzzy" appearance. To prepare for the table, wash the squash, peel thinly, and remove all hard seeds. Place the squash in a steamer and cook for about 30 minutes. Mash and serve with melted butter or with cream sauce. Another way to serve is to peel the vegetable and use it as a casserole lining for pigeon, squab, or chicken which has been quickly seared in hot pork fat. Cover and bake slowly for an hour or until the meat is tender.

#### HUBBARD SQUASH

Hubbard squash, or pumpkin, is an oval-shaped melon having very rough, gnarled skin, and of either a green or greenish-yellow color (Pl. II, fig. 2, 8). To prepare for the table sprinkle the squash with salt, and place it in the oven without removing the peel. Bake slowly for 45 minutes. Serve in the skin; cut into neat pieces, and season with butter.

#### SUMMER SQUASH

Summer squash is a light green oval-shaped melon having smooth skin. It is prepared and cooked like Chinese squash.

#### TARO

The taro is a large, oval-shaped, dark-brown rootstock (Pl. I, fig. 1, 3, and Pl. II, fig. 1, 2). It is usually sold in bunches of three. The taro is eaten boiled or baked, or as poi. The leafstalks also are eaten, and resemble asparagus in taste. Select medium-sized roots when possible. To prepare for the table, peel the roots under water and boil slowly in plenty of water

for 45 minutes. Taros may be scrubbed and boiled in their jackets in cases where the sticky juice of the peeled vegetable produces an irritation of the hands. Serve hot with butter, pepper, and salt. Remnants which are left over from the dinner may be sliced and fried in bacon fat, or made into cakes and fried in deep fat.

#### **TOMATO**

The common tomato is a medium-sized, rounded or oblate fruit with smooth skin (Pl. II, fig. 2, 6). It is a bright red when ripe. All tomatoes should be examined for worm infestation. The common tomato is nearly always used for raw salads. Let it rest in boiling water for a few seconds to loosen the skin. Then drain and remove the skin. Chill on ice, and serve on lettuce leaves, and pour over it a good French dressing.

#### **PLUM TOMATO**

The plum tomato, or Hawaiian tomato, is a small oval-shaped fruit varying in color from bright yellow to red (Pl. II, fig. 2, 4). It is seldom worm infested and for this reason is the best sort of tomato for cooking purposes. To escalop, wash well, peel, cut in half, and place in a buttered tin in alternate layers with seasoned buttered bread crumbs until the dish is full. Top with butter cubes, or with strips of bacon. Bake for 30 minutes.

#### **TURNIP**

The common turnip, or Japanese round radish, is a large, spherically-shaped, flattened white root (Pl. II, fig. 1, 3). To prepare for the table, peel the vegetable thickly, and cook slowly for 45 minutes. Mash with butter, or cut into pieces and serve with cream sauce.

#### **TURNIP GREENS**

Turnip greens are the tops which have been removed from the common turnip. Select fresh, young tops of round turnips. Cut them in small pieces and boil quickly in salted water for 5 minutes. Add butter, salt, and pepper, and cover closely, and steam for 30 minutes.

#### **CHINESE TURNIP**

Chinese turnip or Chinese radish consists of long, fleshy, pure white roots (Pl. II, fig. 1, 6). To prepare for the table, peel the vegetable thickly so as to remove the woody fiber, and boil for 40 minutes. Mash and serve with butter, or cut in cubes and serve with cream sauce.

#### **JAPANESE TURNIP**

Japanese turnip, also called "Japanese radish" and "daikon," is similar to the Chinese turnip, but considerably larger. It is prepared and cooked like the Chinese turnip.

#### **WATER CRESS**

Water cress consists of long, tender stems having small, lobed leaves. (Pl. I, fig. 1, 2.) It is used in salad, or cooked like greens. When cooked it should be cut into small pieces and served with finely chopped fried bacon.

#### **VARYING THE DIET**

Perhaps the most perplexing problem of the average housekeeper is how to plan her meals so that they will show variety and continually appeal to the family tastes. Everyone knows that even the most attractively served foods become tiresome when they are served too often. The worries incidental to meal-planning should be reduced to a minimum in Hawaii where an abundance of fresh vegetables can be had at all times (Pl. III), and where, for instance, any one of a dozen greens or roots having a similar nutritive





FIG. 1.—A TYPICAL TRUCK FARM IN HAWAII (MANOA VALLEY, OAHU)



FIG. 2.—THE CHINESE VEGETABLE MAN; A FAMILIAR SIGHT IN HONOLULU  
TWELVE MONTHS IN THE YEAR



value and differing sufficiently in taste to gratify the palate, can readily be substituted for others which are not so well liked. In fact, it would not be difficult to plan a well-balanced diet from locally grown food products alone. This, however, would not always be economical or advisable from a dietetic standpoint, and it is only with respect to green, succulent vegetables that the question of adaptation to the locally grown products becomes of paramount importance.

The following list of menus, made up of Hawaiian grown vegetables and fruits, supplemented with meats and dairy products, may assist the housekeeper to plan her meals for the week.

### A WEEK'S BILL OF FARE <sup>11</sup>

#### MONDAY

##### BREAKFAST

Papaya with lime.	Soft-boiled egg.	Graham toast.
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##### LUNCH

Lettuce and tomato salad.	Bread and butter.	Banana sauce.
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##### DINNER

Creamed vegetable soup.	Meat.	Steamed chard.	Creamed potatoes.
	Custard pudding.		

#### TUESDAY

##### BREAKFAST

Sliced figs and cream.	Scrambled eggs.	Baking powder biscuits.
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##### LUNCH

Cottage-cheese salad.	Graham muffins.	Marmalade.
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##### DINNER

Fruit cocktail	Baked red snapper.	Creamed carrots.
Chinese cabbage.	Mango sauce.	Cookies.

#### WEDNESDAY

##### BREAKFAST

Baked apple.	Fried-bacon sandwich.	Orange marmalade.
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##### LUNCH

Barley soup.	Graham crackers.	Rhubarb pie.
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##### DINNER

Stuffed-tomato salad.	Fish chowder.	Strawberry shortcake.
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<sup>11</sup> The menus are general in their nature and are chiefly for the purpose of illustrating the proper balancing of the diet, particularly with respect to vegetables. They may be elaborated upon by including other articles of food, similar in their functions to those listed, without materially affecting the balance of the menu.



## THURSDAY

## BREAKFAST

Half a glass of Hawaiian orange juice.	Poached egg on toast.
Pineapple jam.	

## LUNCH

Spinach with egg.	Graham bread and butter.	Baked banana.
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## DINNER

Shrimp salad.	Macaroni and cheese.	Chinese peas.	Summer squash.
	Apple pie.		

## FRIDAY

## BREAKFAST

Rhubarb sauce.	Steamed egg.	Graham toast.
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## LUNCH

Escaloped potatoes.	Stuffed green peppers.	Cake.	Glass of milk.
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## DINNER

Head lettuce with Thousand Island dressing.	Broiled ham.
Brown bread.	Watermelon.
Creamed spinach.	Baked beans.

## SATURDAY

## BREAKFAST

Grapefruit.	Fried bacon.	Fried bananas.	Muffins.
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## LUNCH

Buttered beets.	Corn on the ear.	Hot rolls.	Guava jelly.
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## DINNER

Fruit salad.	Broiled steak.	Steamed onion.	Baked potatoes.
	Mango Brown Betty.		

## SUNDAY

## BREAKFAST

Strawberries and cream.	Broiled ham.	Waffles.
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## LUNCH

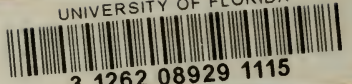
Cold salmon loaf.	Beet and cucumber salad.	Hot baking-powder biscuits.
	Pineapple creamed pudding.	

## DINNER

Watermelon cocktail.	Roast chicken.	Chinese peas.	Mashed potatoes.
	Apple and date salad.	Coconut-cream pie.	



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